

Claims

1. A method for producing a spark plug including a center electrode, an insulator having an axial hole in an axial direction for holding the center electrode 5 on a front end side of the axial hole, a metal shell for holding the insulator while surrounding the circumference of the insulator, and a ground electrode having one end portion joined to the metal shell, and the other end portion to which a columnar noble metal 10 tip facing the center electrode is welded, wherein the noble metal content in a position far by about 0.05 mm inward a molten portion between the noble metal tip and the other end portion of the ground electrode from a boundary surface between the molten portion and a 15 non-molten portion of the noble metal tip becomes 60 % or higher,

the method comprising the steps of:

resistance-welding a bottom surface of the noble metal tip on a side opposite to a counter surface of the 20 noble metal tip to an inner surface of the other end portion of the ground electrode on a side opposite to the center electrode to thereby form a flange portion having a swollen outer diameter of the noble metal tip in a bottom portion of the noble metal tip; and  
25 welding the noble metal tip to the ground electrode

in such a manner that a laser beam is applied on the whole circumference of the flange portion of the noble metal tip.

5           2. A method for producing a spark plug including a center electrode having a front end portion to which a columnar noble metal tip is welded, an insulator having an axial hole in an axial direction for holding the center electrode on a front end side of the axial hole, a metal shell for holding the insulator while surrounding the circumference of the insulator, and a ground electrode having one end portion joined to the metal shell, and the other end portion facing the center electrode, wherein the noble metal content in a position far by about 10 0.05 mm inward a molten portion between the front end portion of the center electrode and the noble metal tip from a boundary surface between the molten portion and a non-molten portion of the noble metal tip becomes 60 % 15 or higher,

20           the method comprising the steps of:

resistance-welding a bottom surface of the noble metal tip on a side opposite to a counter surface of the noble metal tip facing the ground electrode to the front end portion of the center electrode to thereby form a 25 flange portion having a swollen outer diameter of the

noble metal tip in a bottom portion of the noble metal tip; and

welding the noble metal tip to the center electrode in such a manner that a laser beam is applied on the whole  
5 circumference of the flange portion of the noble metal tip.

3. A method for producing a spark plug according to claim 1 or 2, wherein the noble metal tip is  
10 resistance-welded so that the sectional area of the flange portion in the axial direction of the noble metal tip is not smaller than 1.3 times as large as the area of the counter surface.

15 4. A method for producing a spark plug including a center electrode, an insulator having an axial hole in an axial direction for holding the center electrode on a front end side of the axial hole, a metal shell for holding the insulator while surrounding the  
20 circumference of the insulator, and a ground electrode having one end portion joined to the metal shell, and the other end portion to which a columnar noble metal tip facing the center electrode and a seat tip having a thermal expansion coefficient between that of the noble  
25 metal tip and that of itself between the noble metal tip

and itself are welded respectively, wherein the noble metal content in a position far by about 0.05 mm inward a molten portion between the noble metal tip and the other end portion of the ground electrode from a boundary 5 surface between the molten portion and a non-molten portion of the noble metal tip becomes 60 % or higher,

the method comprising the steps of:

resistance-welding a bottom surface of the noble metal tip on a side opposite to a counter surface of the 10 noble metal tip to the seat tip joined to an inner surface of the other end portion of the ground electrode on a side opposite to the center electrode to thereby form a flange portion having a swollen outer diameter of the noble metal tip in a bottom portion of the noble metal 15 tip; and

welding the noble metal tip to the ground electrode in such a manner that a laser beam is applied on the whole circumference of the flange portion of the noble metal tip.

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5. A method for producing a spark plug including a center electrode having a front end portion to which a columnar noble metal tip and a seat tip having a thermal expansion coefficient between that of the noble metal 25 tip and that of itself between the noble metal tip and

itself are welded, an insulator having an axial hole in  
an axial direction for holding the center electrode on  
a front end side of the axial hole, a metal shell for  
holding the insulator while surrounding the  
5 circumference of the insulator, and a ground electrode  
having one end portion joined to the metal shell, and  
the other end portion facing the center electrode,  
wherein the noble metal content in a position far by about  
0.05 mm inward a molten portion between the front end  
10 portion of the center electrode and the noble metal tip  
from a boundary surface between the molten portion and  
a non-molten portion of the noble metal tip becomes 60 %  
or higher,

the method comprising the steps of:

15 resistance-welding a bottom surface of the noble  
metal tip on a side opposite to a counter surface of the  
noble metal tip facing the ground electrode to the seat  
tip joined to the front end portion of the center  
electrode to thereby form a flange portion having a  
20 swollen outer diameter of the noble metal tip in a bottom  
portion of the noble metal tip; and

welding the noble metal tip to the ground electrode  
in such a manner that a laser beam is applied on the whole  
circumference of the flange portion of the noble metal  
25 tip.

6. A method for producing a spark plug including  
a center electrode, an insulator having an axial hole  
in an axial direction for holding the center electrode  
5 on a front end side of the axial hole, a metal shell for  
holding the insulator while surrounding the  
circumference of the insulator, and a ground electrode  
having one end portion joined to the metal shell, and  
the other end portion to which a columnar noble metal  
10 tip facing the center electrode and a seat tip having  
a thermal expansion coefficient between that of the noble  
metal tip and that of itself between the noble metal tip  
and itself are welded respectively, wherein the noble  
metal content in a position far by about 0.05 mm inward  
15 a molten portion between the noble metal tip and the other  
end portion of the ground electrode from a boundary  
surface between the molten portion and a non-molten  
portion of the noble metal tip becomes 60 % or higher,  
the method comprising the steps of:

20 resistance-welding the seat tip joined to a bottom  
surface of the noble metal tip on a side opposite to a  
counter surface of the noble metal tip to an inner surface  
of the other end portion of the ground electrode on a  
side opposite to the center electrode to thereby form  
25 a flange portion having a swollen outer diameter of the

noble metal tip in a bottom portion of the noble metal tip; and

welding the noble metal tip to the center electrode in such a manner that a laser beam is applied on the whole 5 circumference of the flange portion of the noble metal tip.

7. A method for producing a spark plug including a center electrode having a front end portion to which 10 a columnar noble metal tip and a seat tip having a thermal expansion coefficient between that of the noble metal tip and that of itself between the noble metal tip and itself are welded, an insulator having an axial hole in an axial direction for holding the center electrode on 15 a front end side of the axial hole, a metal shell for holding the insulator while surrounding the circumference of the insulator, and a ground electrode having one end portion joined to the metal shell, and the other end portion facing the center electrode, 20 wherein the noble metal content in a position far by about 0.05 mm inward a molten portion between the front end portion of the center electrode and the noble metal tip from a boundary surface between the molten portion and a non-molten portion of the noble metal tip becomes 60 % 25 or higher, the method comprising the steps of:

resistance-welding the seat tip joined to a bottom surface of the noble metal tip on a side opposite to a counter surface of the noble metal tip facing the ground electrode to the front end portion of the center electrode  
5 to thereby form a flange portion having a swollen outer diameter of the noble metal tip in a bottom portion of the noble metal tip; and

welding the noble metal tip to the center electrode in such a manner that a laser beam is applied on the whole  
10 circumference of the flange portion of the noble metal tip.

8. A method for producing a spark plug according to any one of Claims 4 to 7, wherein the noble metal tip  
15 is resistance-welded in the resistance welding step so that the sectional area of the flange portion in the axial direction of the noble metal tip is not smaller than 1.2 times as large as the area of the counter surface.